CLAIMS

1. An interleaver comprising:

a birefringent element assembly providing two output components which are generally orthogonal to each other; and

a reflector configured to direct the two components from the birefringent element assembly back through the birefringent element assembly.

2. The interleaver as recited in claim 1, further comprising a polarization rotator configured to make the two components approximately orthogonal prior to the two components being transmitted back through the birefringent element assembly.

3. The interleaver as recited in claim 2, wherein:

the reflector comprises a prism;

the polarization rotator comprises at least one waveplate;

further comprising a polarization beam displacer configured to separate two beams output from the birefringent element assembly into four beams which are input back into the birefringent element assembly; and

wherein light travels through the birefringent element assembly twice, once in a forward direction and once in a reverse direction.

4. The interleaver as recited in claim 2, wherein:

the reflector comprises a mirror;

the polarization rotator comprises at least one waveplate;

further comprising a polarization beam displacer configured to separate two beams output from the birefringent element assembly into four beams which are input back into the birefringent element assembly; and

wherein light travels through the birefringent element assembly twice, once in a forward direction and once in a reverse direction.

5. The interleaver as recited in claim 1, wherein the birefringent element assembly is configured such that the two components maintain their polarization directions prior to the two components being transmitted back through the birefringent element assembly.

6. The interleaver as recited in claim 1, wherein the phase delays and the angular orientations of birefringent elements of the birefringent element assembly are selected from the table:

Table III

First Stage Phase Delays	First Stage Orientations	Second Stage Phase Delays	Second Stage Orientations
$\Gamma + 2m_1\pi$, $2\Gamma + 2m_2\pi$, $2\Gamma + 2m_3\pi$	$\varphi_1, \varphi_2, \varphi_3$	$2\Gamma' + 2k_3\pi$, $2\Gamma' + 2k_2\pi$, $\Gamma' + 2k_1\pi$	$90°\pm\varphi_3, 90°\pm\varphi_2, 90°\pm\varphi_1$ (parallel component) $\pm\varphi_3, \pm\varphi_2, \pm\varphi_1$ (orthogonal component) where $\Gamma - \Gamma' = 2l\pi$
$\Gamma + 2m_1\pi$, $2\Gamma + 2m_2\pi$, $2\Gamma + 2m_3\pi$	$\varphi_1, \varphi_2, \varphi_3$	$2\Gamma' + 2k_3\pi$, $2\Gamma' + 2k_2\pi$, $\Gamma' + 2k_1\pi$	$90°\pm\varphi_3, 90°\pm\varphi_2, 90°\pm\varphi_1$ (parallel component) $\pm\varphi_3, \pm\varphi_2, \pm\varphi_1$ (orthogonal component) where $\Gamma - \Gamma' = (2l+1)\pi$
$2\Gamma + 2m_3\pi$, $2\Gamma + 2m_2\pi$, $\Gamma + 2m_1\pi$	$\varphi_3, \varphi_2, \varphi_1$	$\Gamma' + 2k_1\pi$, $2\Gamma' + 2k_2\pi$, $2\Gamma' + 2k_3\pi$	$90°\pm\varphi_1, 90°\pm\varphi_2, 90°\pm\varphi_3$ (parallel component) $\pm\varphi_1, \pm\varphi_2, \pm\varphi_3$ (orthogonal component) where $\Gamma - \Gamma' = 2l\pi$
$2\Gamma + 2m_3\pi$, $2\Gamma + 2m_2\pi$, $\Gamma + 2m_1\pi$	$\varphi_3, \varphi_2, \varphi_1$	$\Gamma' + 2k_1\pi$, $2\Gamma' + 2k_2\pi$, $2\Gamma' + 2k_3\pi$	$\pm\varphi_1, \pm\varphi_2, \pm\varphi_3$ (parallel component) $90°\pm\varphi_1, 90°\pm\varphi_2, 90°\pm\varphi_3$ (orthogonal component) where $\Gamma - \Gamma' = (2l+1)\pi$

Wherein m1, m2, m3, k1, k2, k3 and l are integers (0, ±1, ±2, . . .).

7. The interleaver as recited in claim 1, wherein the reflector comprises a prism.

8. The interleaver as recited claim 1, wherein the reflector comprises a mirror.

9. The interleaver as recited in claim 1, wherein the polarization rotator comprises a half-wave waveplate.

10. The interleaver as recited in claim 1, wherein the polarization rotator comprises a mirror and a quarter-wave waveplate.

11. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises at least one birefringent element.

12. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises a first birefringent element having an angular orientation of φ_1, a second birefringent element having an angular orientation of φ_2 and a third birefringent element having an angular orientation of φ_3;

wherein an order of the first birefringent element, second birefringent element, and third birefringent element is selected from the group consisting of:

first birefringent element, second birefringent element, third birefringent element;

third birefringent element, second birefringent element, first birefringent element; and

wherein the angular orientations are with respect to a polarization direction of light entering the birefringent element assembly.

13. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises:

a first birefringent element having an angular orientation of 45° with respect to a polarization direction of light input to the birefringent element assembly and has a phase delay of Γ;

a second birefringent element has an angular orientation of -21° with respect to a polarization direction of light input to the birefringent element assembly and has a phase delay of 2Γ; and

a third birefringent element has an angular orientation of 7° with respect to a polarization direction of light input to the birefringent element assembly and has a phase delay of 2Γ.

14. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises two birefringent elements.

15. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises:

a first birefringent element having an angular orientation of 45° with respect to a polarization direction of light input to the birefringent element assembly and has a phase delay of Γ; and

the second birefringent element has an angular orientation of -21° with respect to a polarization direction of light input to the birefringent element assembly and has a phase delay of 2Γ;

16. A method for interleaving, the method comprising:

transmitting light through a birefringent element assembly, the birefringent element assembly separating the light into first and second generally orthogonal components; and

transmitting the first and second components back through the birefringent element assembly.

17. The method as recited in claim 16, wherein transmitting the first and second components back through the birefringent element assembly comprises maintaining the same polarization directions of the first and second components before transmitting them back through the birefringent element assembly.

18. The method as recited in claim 16, wherein transmitting the first and second components back through the birefringent element assembly comprises rotating the polarization of the first and second components by 90° before transmitting them back through the birefringent element assembly.